Laparoscopic Versus Open Right Hemicolectomy for Carcinoma of the Colon

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ABSTRACT

Objective: This study aimed to compare the outcomes of laparoscopic resection (LR) with open resection (OR) for right-sided colon cancer.

Methods: During the study period from June 2000 to December 2004, 182 patients (84 men) underwent elective resection for cancer of the right colon. Laparoscopic resection was performed in 77 patients, while 105 patients had open operations. Patients who underwent operations on an emergency basis were excluded. Data on the patients' demographics, operative details, and postoperative complications were collected prospectively. The outcomes of patients with laparoscopic resection were compared with those of patients with open surgery.

Results: There was no difference in the age, sex, presence of premorbid medical conditions, and blood loss between the 2 groups. The mean operative time for open resection was 115.4 minutes and that for laparoscopic resection was 165.1 minutes (P<0.001). Among the 77 patients who underwent laparoscopic resection, 7 (9%) required conversion to an open operation. There was no difference in postoperative surgically related complications including wound infection, leakage, intestinal obstruction, postoperative ileus. Nonsurgical-related complications were also similar. The median time to resumption of a normal diet was 3 days and 4 days in the laparoscopic and open groups, respectively. The median hospital stay in patients with laparoscopic resection was significantly shorter than in patients with open surgery (6.0 days vs 7.0 days, P<0.001). The 2-year overall survival rates were 74% in both groups (P=0.904). In the converted to open (LCOR) group, the hospital stay was significantly longer (LR vs OR vs LCOR, 5.5 days vs 7.0 days vs 9.0 days respectively, P<0.001).

Conclusion: Laparoscopic right hemicolectomy is a safe option for cancers of the right colon. It is associated with a shorter hospital stay and earlier resumption of a normal diet. Mortality and morbidity are similar to that with the open approach. There is no compromise in the survival of patients.

Key Words: Laparoscopic right hemicolectomy, Colon cancer.

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INTRODUCTION

Jacobs et al[1] first reported his successful laparoscopic colectomy in 1991. The advantages of laparoscopic colectomy, which include reduced requirements for analgesics, a lower incidence of wound infection, earlier resumption of a regular diet, faster return of bowel function and normal daily activities, and a shorter hospital stay, have been well documented.[2–6] However, whether these advantages can be weighed against the potential disadvantages of a longer operating duration, probably reduced tumor clearance rate due to limited operating view or loss of tactile sensation during the procedure, increased equipment costs, and most importantly the potential increased morbidity or mortality associated with conversion have not been adequately assessed. There has also been controversy about the application of laparoscopic resection for malignancy. The majority of studies on laparoscopic colectomy[7–9] include a heterogeneous group of patients who underwent different operative procedures and compared patients with benign and malignant disease in a single study.[10]

The aim of this study was to review the outcomes of patients who received laparoscopic right hemicolectomy for carcinoma of cecum, ascending colon, and hepatic flexure and to compare the results with those of open surgery. It was postulated that morbidity and mortality were comparable between patients who underwent laparoscopic and open right colectomy for malignancy.

METHODS

Patients

From June 2000 to December 2004, 182 patients underwent right colectomy for cancer of the right colon (from

cecum to hepatic flexure) in the Department of Surgery, University of Hong Kong Medical Centre, Queen Mary Hospital. Seventy-seven patients had laparoscopic resection (LR) while the other 105 were operated on with open resection (OR). Only patients were included who had confirmed carcinoma of the cecum, ascending colon, or hepatic flexure and who underwent an elective operation of either open or laparoscopic right or extended right hemicolectomy. Patients who had benign disease and who were operated on in an emergency setting were excluded. The surgeons and the patients decided on the choice of the approach after thorough discussion of the procedures and the possible morbidity.

Surgical Technique

The principle cancer surgeries, which include en bloc resection, adequate lymphadenectomy with ligation of lymphovascular pedicles, and clear resection margins, were followed up for both open and laparoscopic resections. The patients received mechanical bowel preparation with polyethylene glycol electrolyte solution the day before the operation, and intravenous antibiotics were administered at the time of anesthesia. In the case of laparoscopic resection, the peritoneal cavity was accessed with the open Hasson technique through a subumbilical incision, and a 12-mm trocar was inserted under direct vision. Pneumoperitoneum was established and maintained with carbon dioxide at a pressure of about 12mm Hg. Three other trocars were then inserted under direct vision. Mobilization of the right colon and hepatic flexure was performed intracorporeally with ultrasonic dissection. Hand-assisted devices were not used during surgery. The vessels were controlled with absorbable clips and divided close to their origins. A small incision at the right upper quadrant or at the midline was made, and the mobilized colon was retrieved out of the peritoneal cavity under wound protection. Transection and anastomosis were performed extracorporeally.

Demographic data including sex, age, and the American Society of Anesthesiology class; intraoperative parameters including blood loss and duration of surgery; postoperative outcome measures, such as the time to resumption of a normal diet and bowel function, duration of hospital stay, overall morbidity and mortality rate; and follow-up data were collected prospectively. Comparisons between the 2 groups were performed on an intention-to-treat basis.

Statistical Analysis

Continuous variables were analyzed with the Student t test or Mann-Whitney U test. The chi-square test was used to analyze the categorical variables. Survival was analyzed by the Kaplan Meier method, and the groups were compared by log-rank test. $P<0.05$ were considered statistically significant. SPSS software version 11.0 (SPSS Corp., Chicago, IL, USA) was used for the analysis.

RESULTS

The demographic data are shown in **Table 1**. There was no significant difference in the age and sex of the 2 groups. Preoperative comorbidities according to American Society of Anesthesiology class and the stage of the diseases were also similar.

Among the 77 patients in the LR group, 7 (9%) patients were converted to an open procedure. Two conversions were due to dense adhesions from previous open cholecystectomy. The other 5 patients were converted because

Table 1.
Demographics for Laparoscopic Resection and Open Resection Groups

	LR* n = 77 (%)	OR* n = 105 (%)	P Value
Mean age (year±SD)	71.25 ± 11.9	71.57 ± 11.4	0.853
Sex (male, %)	32 (41.5)	52 (49.5)	0.287
ASA* class			
I	12 (15.5)	16 (15.2)	
II	46 (59.7)	60 (57.1)	
III	17 (22.0)	24 (22.8)	
IV	0 (0)	1 (1)	
UICC* Stage			0.406
I	7 (9)	8 (7.6)	
II	30 (38.9)	48 (45.7)	
III	21 (27.2)	33 (31.4)	
IV	19 (24.6)	16 (15.2)	
Mean blood loss (mL)	178	158	0.918
Mean operating time (min)	165	115	<0.001
Median hospital stay	6	7	<0.001

* LR = laparoscopic right hemicolectomy; OR = open right hemicolectomy; ASA = American Society of Anesthesiology; UICC: Union Internationale Contre le Cancer.

of advanced tumors that invaded the adjacent organs including duodenum, retroperitoneum, and abdominal wall.

There was no difference in mean blood loss between patients who underwent LR and OR (178mL vs 158 mL, respectively, P=0.918). The mean operating time for LR was significantly longer than that for OR (165 minutes vs 115 minutes, respectively P<0.001).

Regarding the postoperative recovery, the median time to resumption of a normal diet was 3 days (range, 0 to 10) in LR patients, while OR patients required a median of 4 days (range, 0 to 25) (P≤0.001). Both groups had return of bowel function 4 days after the operation. The median hospital stay for LR patients was 6.0 days (range, 3 to 72) compared with 7.0 days (range, 4 to 102) in OR patients (P≤0.001). When the 7 converted-to-open (LCOR) patients were analyzed as a subgroup, it was found that those who had successful laparoscopic surgery (n=70) had a median hospital stay of 5.5 days (range, 3 to 72), which compared favorably with the OR (7.0 days, P≤0.001) and LCOR (9.0 days, P≤0.001) groups.

There was no statistically significant difference in overall nonsurgically or surgically related complications, as listed in **Table 2**. Two (28.5%) of the LCOR patients had prolonged ileus of more than 5 days compared with 2 (1.9%) in the OR patients, P<0.01, whereas other complications

as well as the overall complication rate did not show any statistical difference **(Table 3)**.

No 30-day mortality occurred in the LR group, but 3 OR patients died after the operation. All these mortalities were due to underlying medical comorbidities.

The mean number of lymph nodes sampled in LR and OR patients was 15.8±1.4 and 16.7±1.58, respectively (P=0.699). The mean length of the specimen in LR and OR groups was 26.8±13.5 and 26.4±1.7, respectively, (P=0.742).

Survival

The survivals were analyzed after excluding patients with palliative resections. The median durations of follow-up in LR and OR group patients were 22.3 months and 20.8 months, respectively, P=0.578. There were 2 loco-regional recurrences in the LR and 5 in the OR group and 9 systemic recurrences in each group of patients. No port-site recurrences were documented. The 2-year survival rates were 74.23% and 74.17% in the LR and OR groups, respectively **(Figure 1)**. Therefore, no differences in loco-regional recurrence, systemic recurrence, or survival rate occurred in both groups of patients.

DISCUSSION

Since the first report of successful laparoscopic colectomy by Jacob et al[1] in 1991, there has been rapid development of laparoscopic colonic surgery in the past decade.[11] The majority of colorectal procedures can now be performed with the laparoscopic approach. Laparoscopic colonic resection has become the preferred treatment option for diverticular disease. However, the concern about port-site recurrence, the radicality of resection, and the oncologic outcome limited the application of laparoscopic colec-

Table 2.
Complications

	LR* n = 77 (%)	OR* n = 105 (%)	P value
Nonsurgical			
Cardiac	2 (2.6)	5 (4.8)	0.453
Pulmonary	2 (2.6)	4 (3.8)	0.651
Urological	0 (0)	2 (1.9)	0.223
Deep Vein Thrombosis	1 (1.3)	2 (1.9)	0.751
Overall	4 (5)	11 (10.4)	0.201
Surgery Related			
Wound complications	1 (1.3)	4 (3.8)	0.306
Anastomotic leakage	0 (0)	1 (1.0)	0.557
Ileus	5 (6.4)	2 (1.9)	0.112
Intraabdominal sepsis	0 (0)	1 (1.0)	0.425
Overall	5 (6.4)	9 (8.5)	0.603

* LR = laparoscopic right hemicolectomy; OR = open right hemicolectomy.

Table 3.
Surgery Related Complications of Open vs Laparoscopic Right Hemicolectomy Converted to Open Hemicolectomy

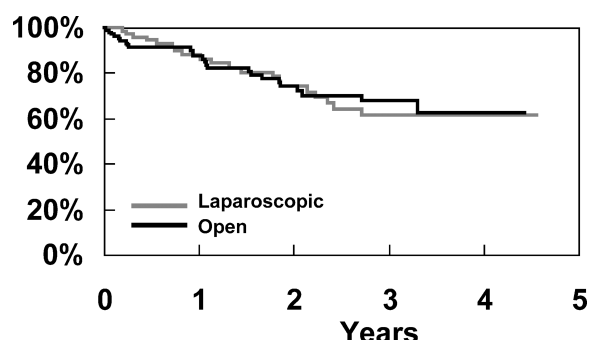|	Open n = 105 (%)	Converted n = 7 (%)	P Value
Wound complication	4 (3.8%)	1 (14.2%)	0.194
Anastomotic leakage	1 (1.0%)	0 (0%)	0.557
Ileus	2 (1.9%)	2 (28.5%)	<0.001
Intraabdominal sepsis	1 (1.0%)	0 (0%)	0.425
Overall	9 (8.5%)	3 (42.8%)	0.085

Figure 1. Overall survival of patients with open and laparoscopic right colectomy (P=0.9045).

tomy for malignant disease. When compared with left-sided colon resection, laparoscopic right colectomy is usually regarded as a laparoscopic-assisted procedure with extracorporeal resection and anastomosis. Thus, laparoscopic right colectomy has a slower pace of development compared with surgery for left-sided colon.[12] There are controversies about whether laparoscopic colectomy has advantages over the open procedure applied in right-sided colonic lesions.

Few publications specifically compare the outcomes in patients who underwent laparoscopic right hemicolectomy for colon cancer with those who were treated with the open approach.[13–17] Among these, preliminary results of comparable morbidity, mortality, oncologic clearance, and survival rate were demonstrated. However, the number of subjects included in these studies was relatively small, and they were included over a long period of time.

The current study included a sizable number of patients with cancer of the right colon, and medium-term oncologic results were also evaluated. Admittedly, this is not a randomized controlled trial and selection bias could not be avoided. However, the demographics of the patients and the stages of the tumors were comparable in the 2 groups. The 2 groups of patients were operated on within the same period with similar preoperative and postoperative management.

The mean operating time was invariably longer in the LR group, 165 minutes due to the more complicated surgical technique requirements as shown in other trials. The learning curve has been quoted to range from 11 to 50 cases or longer compared with the learning curve for open and rectal cancer surgery.[18–21] This can be attributed to the prolonged operation time. No difference in blood loss between the 2 groups of patients was demonstrated in our trial.

The median time to resumption of a normal diet is one day earlier in LR than in OR patients. Despite this, when taking into account that these 2 factors were important considerations in discharging patients from the hospital, they can be regarded as the reasons for the shorter hospital stay in the LR group. Another important finding in breaking down the LR group into those with success (LRs) and those needing conversion (LCOR) is that LRs had a 5.5-day hospital stay, which is ere significantly shorter than the 9 days for the LCOR group. This also brought out a further issue that if the procedure was converted, the hospital stay was even longer than that in the OR group.

The conversion rate of 9% is comparable to that of other trials.[15,18,22] The main reasons were advanced disease with invasion to adjacent organs and the presence of adhesions from previous operations. Conversion in our series is associated with poor outcomes with an increased complication rate and hospital stay. In analyzing the morbidity rate, LCOR patients also had a higher postoperative ileus rate than did OR patients. No difference could be demonstrated in nonsurgically related complications, such as cardiovascular accidents, chest infection, urinary tract infection, deep vein thrombosis, and surgical-related complications like wound infection, anastomotic leakage, ileus, intraabdominal collections. Despite the fact that the overall complication rate is not statistically significant (P=0.085), 42.8% in the LCOR group had complications compared with only 8.5% in the OR group. Therefore, careful selection of patients to minimize the conversion rate so as to minimize the morbidity rate is recommended. In this retrospective study, unfortunately, selection bias was another limitation. Patients were selected for the laparoscopic approach if no absolute contraindication existed instead of being randomized into either group. A randomized controlled trial is thus warranted to further investigate the selection criteria for who is suitable for LR and who is not.

As with many other published data, we did not find any difference in the oncologic clearance, loco-regional recurrence rate, systemic recurrence rate, and 2-year survival rate.[4,5,7–9,12–14] This remained true when LRs and LCOR were compared with OR group patients. Although port-site recurrence had been reported, none of our patients developed this complication.[23–25]

CONCLUSION

Morbidity, mortality, and short-term survival were comparable in the LR and OR groups with the advantages of earlier resumption of a normal diet and a shorter hospital

stay and the disadvantage of longer operating time and risk of conversion with possibly associated increased morbidity.

Laparoscopic right hemicolectomy has comparable morbidity and mortality rates as those of the conventional open procedure. It is superior to the conventional open approach in terms of shorter hospital stay and earlier resumption of a normal diet. However, conversion to open is associated with a longer hospital stay and possibly higher morbidity.

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